

**Air Force Institute of Technology Graduate Education
Re-Engineering Study Team
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Abstract

The mission of the Air Force Institute of Technology is "to provide responsive, defense-focused graduate and continuing education, research, and consultation to improve Air Force and joint operational capability". The goal is to provide mission-ready graduates to our customers, the ultimate employers of our graduates. The students also form a primary customer base. A key process within this mission is to design the size and composition of the graduate faculty.

Since 1989, the United States Air Force has been undergoing revolutionary changes. By FY 99, the officer personnel totals will be reduced by 29% from the FY 89 level, while the AFSCs served by AFIT resident schools will decrease by 34%. By FY 95, the MS degree quotas for the Graduate School of Engineering (EN) and the Graduate School of Logistics and Acquisition Management (LA) had been reduced by 25% and 45%, respectively. Faced with the reality of decreased fully funded student quotas for graduate education programs, AFIT must adapt to these changes and determine the most effective way of conducting graduate education.

On 16 March 1996, Colonel Ronald D. Townsend, AFIT Commandant, initiated the study to determine the future size and scope of the graduate schools in AFIT to reflect the changing environment in the Air Force and to propose an implementation plan. The objective of the team was to review the identified processes and to determine the appropriate size and composition of the graduate schools which would improve efficiency. Efficiency would be measured using cost-per-student-man-year, overall cost reductions, and student/faculty ratios.

The team did not alter an existing process, but rather developed a process to define the optimum size and composition of the graduate education faculty. A model was developed to identify stable education requirements for the Air Force. The team then defined the proper balance of faculty and staff to meet those stable education requirements. Following are the six steps accomplished:

1. Determine the steady-state annual quota needed to sustain the inventory of officers essential to fill Air Force positions which require officers who possess specific advanced degrees. This study employed a linear programming formulation of a Markov decision model to identify the annual steady-state quotas.
2. In recognition that the AFIT resident schools are not the sole providers of all fully-funded Air Force degrees associated with the academic specialties we provide, we determined the historical percentage of fully-funded degrees accomplished in residence for each academic specialty. This percentage was then applied to the steady-state annual quotas to derive the steady-state annual resident quota.
3. Since the actual number of annual fully funded quotas is the product of a budget constrained process, it was necessary to forecast the total number of resident quotas which could be expected to be funded during the planning horizon for this study (FY 99 and beyond).
4. In a similar fashion, a projection was made of the 1999 Ph.D. student quotas for the AFIT residence school.
5. The next step was to determine the annual steady-state resident quotas for the specific academic specialties addressed in this study which combine to form the total projected quota. This study assumed that the *distribution*, by discipline, of steady-state resident quotas was constant. Therefore, if the unconstrained Markov decision model results indicate that a particular AAD code represents 10% of the total quota allocation, then this AAD code was allocated 10% of the total quotas.
6. Given the projected annual steady-state resident quotas the team determined the faculty required to effectively perform the missions of the resident graduate schools. It was assumed that a 6 course unit load (each unit equates to teaching one 4 quarter hour course) would be used to size the faculties. The 6 course unit load is presumed to provide each faculty member sufficient time to advise students, to conduct research and consultation, and for professional development. The team determined the courses which would be required to conduct the academic programs associated with each academic discipline.

Baseline indicators showed that cost-per-student-man-year had increased from \$26,758 in FY 89 to \$35,665 in FY 95. The proposed re-engineering action designed for the extrapolated FY 99 quota of 271 MS students and 27 Ph.D. students reflects a potential savings (after FY 99) of 42 manpower positions in the two graduate schools, and the following potential cost reductions:

- a) Personnel cost reduction from \$15.48M to \$12.25M, producing \$3.23M cost savings and increases the student/faculty ratio from 4.5 to 6.9 for the two schools.
- b) Cost-per-student-man-year decreases from \$35,665 to \$23,612.

This method presumes that a new requirements based system (similar to our Markov decision model) for determining quotas will be established. However, quotas developed through such a

process can be expected to produce quite different distributions from those developed using current methods. Consequently, the re-engineering will be implemented in two phases in order to maintain the ability to meet current quota levels while efforts continue to implement a stable requirements identification system. The **first** implementation phase, currently underway, saves 30 manpower positions immediately and results in the following potential cost reductions:

- a) Personnel cost reduction from \$15.48M to \$13.11, producing \$2.37M cost savings and increases the student/facility ratio from 4.5 to 6.4 for the two schools.
- b) Cost-per-student-man-year decreases from \$35,665 to \$25,305.

Survey data from students, graduates, and supervisors of our graduates

will continue to be monitored to determine whether the usual high quality of our programs is maintained. In addition, periodic evaluation by accrediting agencies are used to ensure that academic excellence is maintained, while academic program reviews are used to ensure we meet the requirements of our Air Force customers. Results of the study will allow AFIT to maintain past levels of excellence, while satisfying our customer requirements in a more efficient manner.

With the overwhelming success of the Graduate School Re-Engineering Team, a similar team was established to review the faculty/staff size and composition of the AFIT Professional Continuing Education (PCE) schools, the methodology serving as a template for future cost effectiveness studies. The methodology proved so successful in this analysis that it has become the standard by which all organizations within AFIT will review the effectiveness and efficiency of their operations. Upon completion of the PCE review, it is anticipated that the staff agencies within AFIT will also perform a review.

The methodology employed by this team, in particular the Markov decision model for requirements determination, has the potential for a far wider implementation and impact for the Air Force at large. The methodology used to evaluate education requirements and adjust faculty size and composition has potential application within Air University and Air Education and Training Command for Professional Continuing Education and Technical Training. This would prove valuable **in** improving the efficiency of all Air Force education and training organizations.

AFIT also continues to work with its customers to improve the education requirements process and its ability to meet their requirements. AFMC is one of the primary customers of the AFIT graduate education programs, employing the bulk of graduates in the engineering, acquisition, and logistics fields. The AFIT Commandant briefed the AFMC Commander on the results of the study and the Markov model used to identify stable, long-term education requirements.

Two team members briefed representatives of the HO AFMC staff (requirements, engineering, personnel, science and technology) on two occasions. AFMC has begun discussions with HQ AFPC (AFIT Liaison and Air Force Education Requirements Board representative), and is anticipating presentation to the AFERB itself. If adopted, stable long-

term education requirements can be identified at the Air Force level for many education and training organizations.

In summary, not only will the results of this study team improve the efficiency of the AFIT graduate schools in the short term, the prospects for far reaching, long-term benefits for the Air Force at large are extremely bright.

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